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Title: A strategy for implementing genomics into nursing practice informed by three behaviour change theories

Verity LEACH PhD BSc Hons
Research Associate
CLAHRC West
School of Social and Community Medicine
University of Bristol
Whately Road
Bristol

Emma TONKIN PhD BSc Hons
Senior Research Fellow, Genomics Policy Unit
Faculty of Life Sciences and Education, University of South Wales
Pontypridd
Wales

Deborah LANCASTLE PhD BSc Hons CPsychol
Registered Psychologist
Senior Lecturer in Psychology,
School of Psychology, Early Years and Therapeutic Studies
University of South Wales
Pontypridd

Maggie KIRK PhD BSc Hons RGN FRCN.
Professor, Genomics Policy Unit,
Faculty of Life Sciences and Education, University of South Wales
Pontypridd
Wales

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Abstract

Genomics is an ever increasing aspect of nursing practice, with focus being directed towards improving health. The authors present an implementation strategy for the incorporation of genomics into nursing practice within the UK, based on three behaviour change theories and the identification of individuals who are likely to provide support for change. Individuals identified as Opinion Leaders and Adopters of genomics illustrate how changes in behaviour may occur among the nursing profession. The core philosophy of the strategy is that genomic nurse Adopters and Opinion Leaders who have direct interaction with their peers in practice will be best placed to highlight the importance of genomics within the nursing role. The strategy discussed in this paper provides scope for continued nursing education and development of genomics within nursing practice on a larger scale. The recommendations may be of particular relevance for senior staff and management.

Key words: behaviour change, Diffusion of Innovations, genomics, Stages of Change, Theory of Planned Behaviour

Background

Healthcare researchers are constantly looking for ways to translate research findings into practice[1] and this is no different for the nursing community[2,3]. Genomics is now a fundamental aspect of health care offering improvements in diagnosis, prognosis, treatment, risk assessment and management. As such nurses have a responsibility to be knowledgeable about the potential benefits and challenges of genomics in their sphere of practice in order to inform and care for individuals and families[2,4]. It is time to move beyond justifying the relevance of genomics in nursing practice[5,6] and to focus on building the evidence base for practice[7,8]. This is being brought into even sharper focus as epigenomics research is revealing the implications of genome-environment interactions for long term health, and precision medicine aims to tailor treatment options based on our understanding of genomics and epigenomics[9,10]. Calzone *et al*, 2012[11], used the Diffusion of Innovations theory to evaluate genomic competencies among the current US nursing workforce and to inform the further diffusion of such knowledge. However, there is limited evidence of the process of integrating genomics into nursing practice[4]. It is envisioned that as research into the delivery of effective genomics-based nursing care continues, the translation of evidence into practice will be accelerated[12,8]. As there is currently no articulated strategy within the UK for achieving this transformation the purpose of this paper is to set out how an understanding of change theories, which describe the influencing factors associated with the translation of evidence into practice, and of the common characteristics of different groups of nurses who have the potential to influence change, can be applied to accelerate uptake of genomics into nursing practice.

We have previously argued that identifying the characteristics of nurses and the way they have, or have not responded in practice to genomics could help inform an implementation

strategy[13,14]. Adopters and Opinion Leaders as they are termed by Rogers[15] (1962) (Figure 1) would provide a key positive influence within the strategy proposed here and could be utilised to drive the need for change amongst the profession. Previous research by the authors[13,14] used an online survey of UK oncology and practice nurses (n=88) to identify common characteristics of those already integrating genomics into their practice In this paper we use the term genomics to refer to both genetics and genomics. However, the term 'genetics' is used when referring to Adopter and Opinion Leader groups to reflect nomenclature used in our original survey. Four individual characteristic groups were identified (Table 1) and are summarised below:

Genetic Adopters – have an overall interest in genomics which they attempt to integrate into practice and are familiar with certain genomic issues and resources.

Opinion Leaders (OLs) - are able to influence colleagues, but not necessarily about any particular topic.

Genetic Opinion Leaders (GOLs) - a small, specialist group of nurses, who have the same characteristics as Adopters and have the ability to lead and influence others[13].

Opinion Leaders With an Interest in Genetics (OLWIGs) - have an interest in genomics and can influence those around them, but have not incorporated genomics into practice like GOLs.

Behaviour change theories

Insights gained from the original research have been used to develop a framework to establish and accelerate change around genomic healthcare among nurses. With a number of behaviour change theories available, often with overlapping constructs, Francis[16] and colleagues (2012) suggest it is difficult to justify an implementation strategy that uses only one theory. We have

drawn on three theories: Diffusion of Innovations theory (Rogers, E), Stages of Change theory (Prochaska, J.O) and the Theory of Planned Behaviour (Ijzen, I):

Diffusion of Innovations (DoI)

DoI is a widely studied theory which sets out the process by which new ideas and initiatives are implemented into a society or organisation by defining the stages of innovation implementation[17].

Stages of Change Theory (SOC)

The SOC theory provides an explanation of how individuals work through the behaviour change process and can be used to guide healthcare professionals and educators seeking to influence behaviour change[18]. Jenkins and Calzone (2012) recently used SOC to guide a strategy around the integration of genomic content into US nursing curricula.

Theory of Planned Behaviour (TPB)

The TPB has been used extensively in health promotion initiatives and research[19,20]. It provides the central theoretical basis for this work as it offers an in-depth perspective of behavioural change, with several components including subjective norms, perceived behavioural control and salient beliefs.

Opinion leadership

OLs represent a human resource that can become involved in the implementation of new innovations and have been linked to increasing the speed of DoI. OLs exhibit particular characteristics which can be demonstrated to others, allowing an innovation to be implemented from the 'inside out' by members of the same peer group[21]. We propose that opinion leadership could provide the real link between the innovation and the individuals who will be implementing it.

All three behaviour change models, whilst providing theoretical overlap also bring different considerations to behaviour change theory (Table 2[15,22,23,24,25]). Both the DoI and SOC theories have a linear approach to change, from non-adoption through to adoption, but do not consider possible influences on behaviour change. The TPB appears to recognise more of the complexities of behaviour change, with the inclusion of influencing factors such as behaviour and control beliefs.

Strategy

We present here a framework to help inform change strategies for organisations seeking to increase integration of genomics into nursing practice (Figure 2[24]). TPB is the core underpinning theory, with the DoI and SOC theory providing further descriptive elements. The role of Opinion Leadership, is considered in light of the role OLs can play in facilitating behaviour change. The steps numbered in Figure 2 are detailed below.

1. Attitudes, subjective norms and perceived behavioural control all affect intentions to adopt genomics into practice (the behaviour). We suggest that GOLs and Adopters in particular have the potential to effect a subtle shift in subjective norms (the social pressure to perform or not perform a given behaviour) which in turn would have a positive influence on behaviour change. Attitudes will be affected by perceptions of the relative advantage of incorporating genomics within practice, available knowledge of genomics and clarification of the reasons for incorporating genomics into practice. Attitudes and perceived behavioural control towards the innovation could be enhanced by Adopters, OLWIGs and GOLs who provide non adopters with positive perceptions of the innovation. Much of the influence towards encouraging behaviour change will be through regular interactions in the everyday practice setting. The persuasion and clarity with which the innovation is delivered could help nurses become motivated about adopting genomics into

practice and increase the extent to which this is seen as normative practice. OLs and OLWIGs would be important in this regard as they have the ability to influence those around them. With the genomic expertise from Adopters and GOLs, the OLs and OLWIGs could also motivate non-adopters and promote positive beliefs about genomics. The perceived behavioural control regarding the integration of genomics into practice could be improved by using clear explanations and relevant examples to demystify the complexity of the innovation.

2. Behavioural intentions regarding the intention to adopt genomics into practice are linked to the preparation stage and the decision stage as they relate to the time point when an individual is considering whether to adopt the behaviour. The opportunity to be able to trial the innovation may be important at this stage, allowing non adopters to see how genomics may improve their practice and patient care. With their knowledge and interest in genomics, adopters and GOLs could supervise and mentor these 'trial opportunities' (for example the use of family health history questions to gather information on potential health risks or support in how to discuss the offering of targeted treatments based on genomic tests such as cancer tumour profiling). GOLs, Adopters and possibly OLWIGs may also influence the attitude, social norms and perceived behavioural controls of those at the contemplation stage. As a result there could be constant influence by those at a later stage of behaviour change or implementation on non-adopters working through initial stages.

3. At the behaviour stage, the non-adopters are adopting genomics into their practice. GOLs, Adopters and OLWIGs who are already at this stage could have influence over those at the preparation and decision stage. OLWIGs, due to their interest in genomics could influence non-adopters. Adopters and GOLs could encourage and support non adopters with their genomics knowledge and interest.

4. The routinising/confirmation stage is the stage after an individual has adopted genomics into their practice and are consolidating their decision and skills. Those GOLs and Adopters who are at this stage could help to work with managers and educators to overcome the barriers to the incorporation of genomics into practice. The redefining/restructuring stage is the time when the innovation is altered if needed, before going through another 'round' of acquiring Adopters. Adopters and GOLs could help at this stage as they evaluate their own practice as part of continuing improvement, to inform those involved in the diffusion of the intervention (specifically the integration of genomics into nursing practice) on how they could improve the clarity and compatibility of the innovation in order to make the transition from non-adopter to adopter more successful.

Potential strategy application

Based on the framework set out here, the authors believe strategies can be created for the further integration of genomics into nursing practice at both local and national levels. Such strategies would centre on the identification of Adopters, OLWIGs and GOLs across a particular geographical or practice area, which would allow for the creation of a network of 'genomic points of contact' for an area/department. The activity would be ongoing, with training provided to the identified Adopters and OLs. Over time new Adopters could be incorporated into the network. Tailored education relating to the specific adopter groups would be offered that could include core genomic skills, influencing and assertiveness and people skills.

Key strategy considerations

Any strategy involving a large workforce and an area that is not yet wholly accepted (as in this case) will take time to implement. A fundamental factor that will drive the incorporation of genomics into practice will be the provision of applicable and relevant genomic education

for pre and post registered nurses. Whilst the initiative from Health Education England[25] is offering fully funded places for NHS staff in England to study for a masters in genomic medicine, uptake from nurses will depend on them recognising the need for genomics within their practice and having a core knowledge upon which to build. In the UK, the Nursing and Midwifery Council (NMC) made limited reference to genomics in the revised pre-registration nursing education guidelines[26], despite the House of Lords' report on Genomic Medicine[27] (2009) highlighting the need for more genomic education among the NHS workforce, making specific reference to the NMC in relation to this. The need for greater genomic education among nurses was emphasised again in the Task and Finish Group Report[28] (2011) into genomics in nursing and midwifery and the landscape is unlikely to have changed in the intervening period. Williams[29] *et al* (2011) emphasised that the preparation of educators to close the gap in genomic nursing education is an essential component of achieving a workforce that can use genomic knowledge appropriately. Kirk *et al*. (2013) reiterated the importance of active nursing leadership in driving competence in genomics which is grounded in clinical relevance[30]. In the US, Jenkins & Calzone[6] (2014) identified Faculty Champions (similar to OLs) in various nursing schools over a one year intervention period to facilitate genomic curriculum integration within education settings utilising the underpinning concepts of DoI and this proved to be an effective strategy in improving integration of genomic education. Directed and purposeful education that builds on existing knowledge and skills for Adopters, GOLs and OLWIGs will help to support and nurture these individuals in their roles as mentors and ambassadors within their practice environment. It will also be important to provide work-based learning for nurses, so they can not only witness the importance of genomic knowledge but also apply it to their specialism.

Implementing genomics across nursing practice needs to be an evolution, not a revolution, hence the importance peer level activity. Whilst gaining the support and backing of

department heads, executives and regulatory bodies like the NMC in the UK is important, the role of the Adopters and GOLs at ward and community levels should not be underestimated. We have identified a number of barriers and facilitators to incorporating genomics more into practice[13,14]. The success of any strategy will be dependent on cost and ease. The cost of identifying participant groups on a national scale would be challenging in the current fiscal climate, but might be more feasible at regional levels. Targeting nurses during training and supporting and encouraging them as they begin their careers could be effective in distinguishing future OLs and Adopters. Some nurses might not have had the opportunity to adopt genomics in their current practice but have the characteristics to be future Adopters or OLs. This would mean that a new generation of nurses could be encouraged to adopt genomics and act as genomic 'role models' early in their career before the habits and assumptions of disinterested others might be assumed. In order for genomics to be given the 'push' it requires, strategic leadership within the nursing workforce is a necessity.

A strategy for accelerating change

Each of the three change theories has a role to play in informing future genomic implementation strategies. The DoI, SOC and TPB all bring different perspectives. Each has limitations, but creating a framework that reflects the principles of all three theories minimises the individual constraints of each. For example, the lack of accountability for personality traits within the TPB is a limitation, but the impact of this within the combined strategy is minimised through the incorporation of personality from the DoI theory and the function of opinion leadership. Although any framework has its limitations, the authors feel that a strength of the one proposed is the combination of the three behaviour change theories. The Adopters, GOLs and OLs all have different areas of influence depending on the theory being utilised. When the theories are combined (Figure 2) the three groups play an integral

role in the attitude towards the innovation, the intention that those around them have to adopt genomics and the way the behaviour is eventually adopted. Each group has a different way they can promote the incorporation of genomics into nursing practice. For Adopters it is the potential to work alongside colleagues in their department and attest to the use and relevance of genomics. For OLs it is the possibility of teaming with Adopters to have a level of influence over colleagues. This might require a level of adoption of genomics on their part and their characteristic of being open to new ideas and experiences is beneficial here. For GOLs it is that ability to combine their knowledge and interest in genomics with their power to influence others and lead change in practice. We believe this framework goes some way to aiding these preparations and has relevance for genomics within nursing on a global scale, although it is recognised that characteristics of Adopter groups may vary among cultural settings and as such would require further investigation.

We recognise the importance of any strategy utilising this framework being partnered with a developing 'toolkit' of evidence based nursing interventions. Implementation of evidence in practice is often not accomplished[31] and it is well recognised that there is a greater need for evidence based genomic nursing interventions[7]. Williams *et al*[9] (2015) acknowledge that more needs to be done to facilitate the integration of genomic discoveries into healthcare practice. With regard to precision medicine, simply making genomic discoveries is not enough and effective translation into practice is vital. We need to assess how such discoveries contribute to health outcomes for individual patients and elucidate the issues around the integration of this knowledge across diverse population and healthcare settings[9], through the most effective nursing interventions. Whilst the efforts of nurse researchers are undoubtedly helping to realise this[32], the evidence base for such interventions remains scarce

Limitations

The framework proposed has arisen following the identification of characteristics of genetic Adopters and OLs and we recognise and have discussed the limitations of this underpinning work previously[13,14]. Sandstrom[33] *et al* (2011) state that the structure of an organisation also affects the implementation process. As healthcare providers may have varying policies, processes and staffing structures, it would be useful to consider organisational structure in future studies and particularly how these might impact or shape the characteristics of the individual groups. Another area for future research is the influence of environmental and social factors on a nurse's ability to integrate genomics into practice.

Conclusion

When the complementary factors of the three theories are used to produce an overarching framework, the strength of utilising Adopters and OLs for promoting change within a challenging area is highlighted. We believe that the identified characteristics of the four groups in combination with this frameworks can be utilised to aid the incorporation of genomics into nursing practice. For the success of such a strategy, support and enthusiasm from nursing organisations and health service providers will be required along with the wide scale identification of Adopters and OLs throughout the nursing community. The use of these identifying characteristics should help to enable genomics to be utilised in practice at a 'local' level, through employment and engagement of these participant groups and replicated at other locations. Genomics is a growing and essential part of healthcare and it is prudent to capitalise on the leadership qualities of nurses in driving change, for the ultimate benefit of patients and families.

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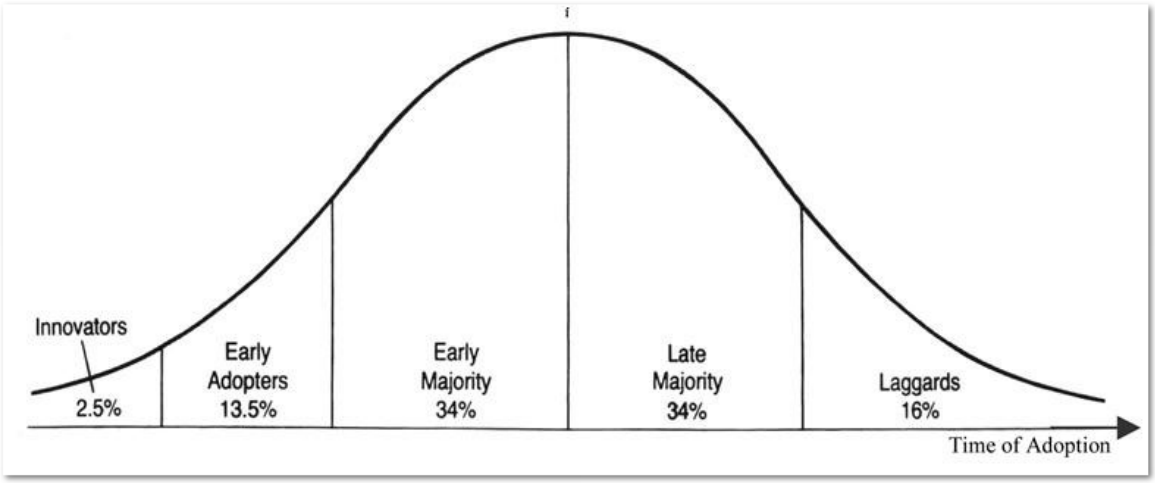

Figure 1. Rogers' Bell Curve of the Characteristics of Innovators taken from Rogers[12] E M (1962)

Innovators are the first actively to adopt an innovation, followed by early adopters and then early majority, late majority with the laggards being the last to adopt (Rogers 2003). Each category of adopter may then act as an influencer and reference group for the next.

Note. The chart shows that early and late majority adopters fall within 1 standard deviation (SD) of the mean time taken to adopt an innovation on either side, accounting for 34% of the population. Early adopters fall within 2 SD's of the mean (accounting for 13.5%) while innovators are greater than 2 SD's below (2.5%) and laggards are greater than 1 SD above (16%).

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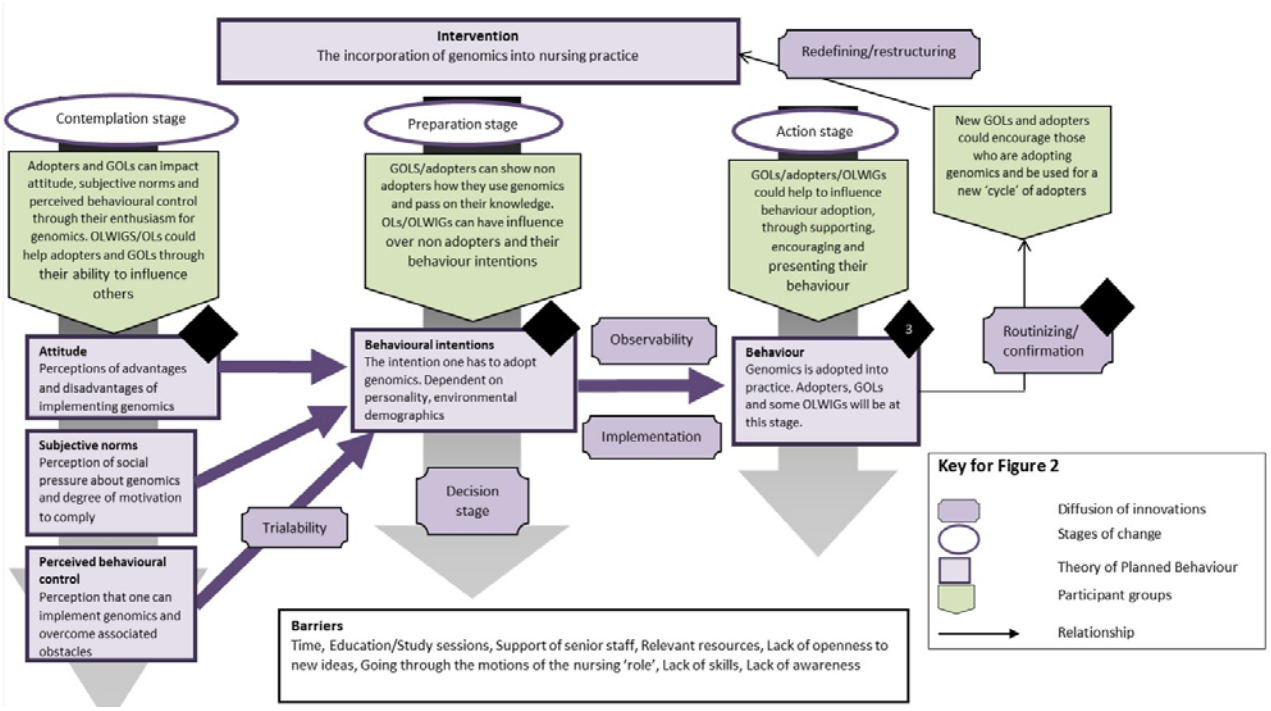

Figure 2. Adaptation of the Theory of Planned Behaviour model by Perkins[21] *et al.* (2007) made unique to the innovation of genomics in nursing whilst also encompassing the Diffusion of Innovations theory and the Stages of Change theory (For detail on steps 1-4, refer to text).

Table 1. The distinguishing characteristics of Opinion Leaders (OLs), Opinion Leaders with an Interest in Genetics (OLWIGs), Genetic Opinion Leaders (GOLs) and Adopters (taken from Authors 2013a & 2013b[10,11])

OLs	OLWIGs	GOLs	Adopters
		N (%)	
19 (21.6)	11 (12.5)	6 (6.8)	24 (27.3)
		Characteristics	
	Older in years	Older in years	
Higher academic ability	Higher academic ability	Higher academic ability	
Higher professional grade	Higher professional grade	Higher professional grade	
High openness to experience		High openness to experience	Openness to experience
Higher perceived influence over others	Higher perceived influence over others		
High on the opinion leadership scale	High on the opinion leadership scale	High on the opinion leadership scale	
Keen to incorporate more genomics into practice	Keen to incorporate more genomics into practice	Keen to incorporate more genomics into practice Relevance for CPD	
	Understand the relevance of genomics to their practice	Understand relevance of genomics to their practice	Understand relevance of genomics to their practice
	Less familiar with genomic resources	Familiar with genomic resources	Familiar with genomic resources
		Positive attitude to genomic and career statements	Positive attitude to genomic and career statements
		Ability to apply genomics into practice	Ability to apply genomics into practice
		Understand areas of nursing care linked to genomics	Understand areas of nursing care linked to genomics
		Confident in taking a family history	Confident in taking a family history
	Unaware of Regional Genetics Centres*	Awareness of Regional Genetics Centres	Awareness of Regional Genetics Centres
	Less likely to understand importance of identifying someone to refer to genetic services	Know the types of support services available to patients	Know the types of support service available to patients
		Able to talk to colleagues about genomics	Able to talk to colleagues about genomics
		Interested in new areas of genomic knowledge	Interested in new areas of genomic knowledge
		More likely to seek genomic knowledge for individuals	More likely to seek genomic knowledge for individuals
		Find it easier to apply new knowledge into practice	Find it easier to apply new knowledge into practice
		Feel expectation from colleagues and doctors to incorporate genomics into practice	Feel expectation from colleagues and doctors to incorporate genomics into practice
		Patients encourage them to seek new areas of knowledge	Patients encourage them to seek new areas of knowledge

*The Regional Genetics Centres provided genetic services within the UK as part of the National Health Service. There are 31 RGCs in the UK

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Table 2. Overview of behaviour change theories

	Behaviour change theories		
	Diffusion of Innovations	**Stages of Change**	**Theory of Planned Behaviour**
Core concept	The theory sets out the process by which new ideas and initiatives are implemented into a society or organisation[12]. Opinion Leaders are often used to promote behaviour change and often adopt an idea before the majority does[18]. They have been linked to increasing the speed of Diffusion of Innovations.	The theory specifies that behaviour change is a process that develops over time and through a 'cascading' approach of an individual's behaviour towards an innovation[19].	The main focus of TPB is an individual's intention to perform a behaviour. Attitudes towards the behaviour, the social pressure to perform the behaviour and its perceived ease or difficulty all influence the intention to perform the behaviour[20].
Stages	Knowledge Persuasion Decision Confirmation	Precontemplation Contemplation Preparation Action Maintenance Termination	Attitude Subjective norms Perceived Behavioural Control Intention Behaviour
Relevance to current study	Enables an understanding of the characteristics that define the speed of adoption of an innovation, therefore enabling greater influence to be placed upon the integration of the innovation (in this study, the integration of genomics into practice) into a social system.[14]	Aids the understanding of how individual nurses might progress through the stages of adopting genomics into practice, allowing the mechanism of change to be controlled or modified.	Provides insight into how intention variables, such as perceived behavioural control and subjective norm (i.e. social pressures) can be manipulated in order to increase the uptake of the behaviour.